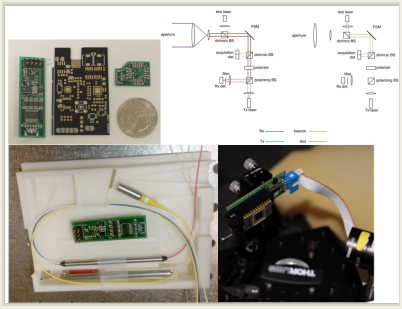
Small Business Innovation Research/Small Business Tech Transfer

Optical Intersatellite Communications for CubeSat Swarms, Phase I

Completed Technology Project (2017 - 2017)

Project Introduction

The growing interest in CubeSat swarm and constellation systems by NASA, the Department of Defense and commercial ventures has created a need for self-managed inter-satellite networks capable of handling large amount of data while simultaneously precisely measuring the distances between the spacecraft. CrossTrac Engineering, Inc., in cooperation with our partners Professor Kerri Cahoy of the Massachusetts Institute of Technology and Mr. Paul Graven of Cateni, Inc., proposes to develop a free space optical communications and ranging system with inherent precision pointing as a 1U module for 3U and larger CubeSats requiring intersatellite crosslinks. Based on technology developed by Professor Cahoy and her team at MIT, the module will enable small satellites to achieve the sub-milliradian pointing control of the optical beam necessary to close laser crosslinks at ranges from 200 km to 1000 km with input power of less than 20 W and data rates of 100 Mbps and greater, all within a 10 cm x 10 cm x 10 cm (1U) volume or smaller. The proposed work is directly aligned with the STTR solicitation T11.02 and the objectives of Technology Area 5.1 Optical Communications and Navigation in the NASA 2015 Technology Roadmap.1 Optical crosslinks are a key technology that will enable new multi-spacecraft CubeSat and microsatellite missions. These missions include large constellations for global data distribution and rapid response Earth imaging and asset tracking as well as swarm missions that, among other tasks, can be formed into sparse aperture systems providing unprecedented image resolution. These swarm missions require precise relative position knowledge as well. The optical terminal being developed under this effort will provide this sub-mm level relative position knowledge. Furthermore, the free space optical crosslinks can be used to make atmospheric composition and thermophysical measurements (e.g., via laser occultation).



Optical Intersatellite Communications for CubeSat Swarms, Phase I Briefing Chart Image

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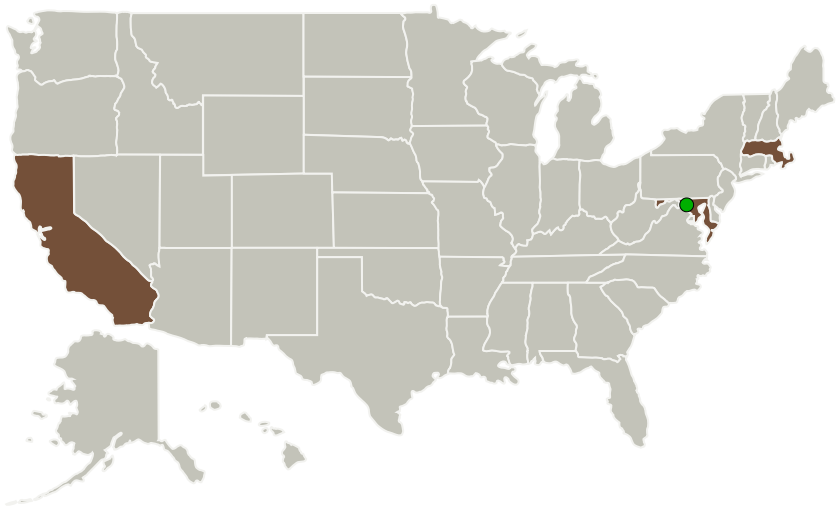
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
CrossTrac Engineering, Inc.	Lead Organization	Industry	Mountain View, California
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland
Massachusetts Institute of Technology(MIT)	Supporting Organization	Academia	Cambridge, Massachusetts

Primary U.S. Work Locations	
California	Maryland
Massachusetts	

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

CrossTrac Engineering, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

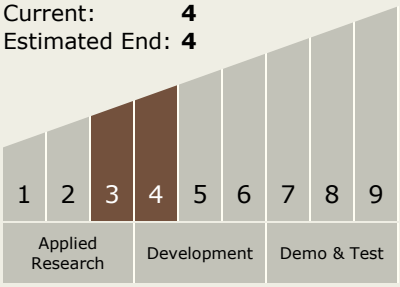
Carlos Torrez

Principal Investigator:

John E Hanson

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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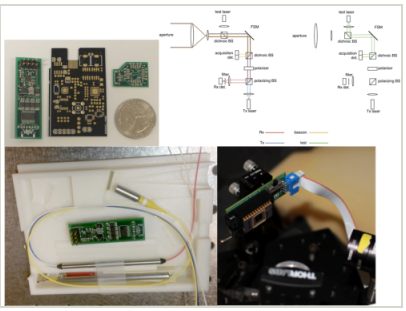
Images



Briefing Chart Image
Optical Intersatellite Communications for CubeSat Swarms, Phase I Briefing Chart Image
(https://techport.nasa.gov/image/131662)

Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.1 Optical Communications
    - TX05.1.4 Pointing, Acquisition and Tracking (PAT)

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System